

8. REGULATIONS AND ADVISORIES

Hydrogen fluoride is on the list of chemicals appearing in "Toxic Chemicals Subject to Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986" (EPA 1987). Fluorine, sodium fluoride, and the class of chemicals known as fluorides do not appear on that list.

No international regulations pertaining to fluorides were found. The national and state regulations and guidelines regarding fluorine, hydrogen fluoride, and fluorides in air, water, and other media are summarized in Table 8-1.

An acute-duration inhalation MRL of 0.01 ppm has been derived for fluorine. This MRL is based on a NOAEL of 10 ppm for respiratory effects in humans exposed to fluorine for 15 minutes (Keplinger and Suissa 1968). The MRL was derived by adjusting the NOAEL for <24-hour exposure and dividing by an uncertainty factor of 10 (to account for human variability).

An acute-duration inhalation MRL of 0.03 ppm fluoride has been derived for hydrogen fluoride. This MRL is based on a NOAEL of 98 ppm for nasal irritation in rats exposed to hydrogen fluoride for 60 minutes (Rosenholtz et al. 1963). The MRL was derived by adjusting the NOAEL for less than 24-hour exposure and multiplying by the RDGR to calculate a NOAEL_{HEC}. This value was then divided by an uncertainty factor of 30 (3 for interspecies extrapolation using dosimetric adjustments and 10 to account for human variability).

An intermediate-duration inhalation MRL of 0.02 ppm fluoride has been derived for hydrogen fluoride. This MRL is based on a LOAEL of 2.98 ppm for slight nasal irritation in subjects exposed to hydrogen fluoride 6 hours/day for 15–50 days (Largent 1960). The MRL was derived by adjusting the LOAEL for intermittent exposure and dividing by an uncertainty factor of 30 (3 for use of a LOAEL for a minimal effect and 10 to account for human variability).

A chronic-duration oral MRL of 0.06 mg fluoride/kg/day has been derived for fluoride. This MRL is based on a LOAEL of 0.56 mg fluoride/kg/day for skeletal effects (increased fracture rate) in postmenopausal women with osteoporosis (Riggs et al. 1990, 1994). The MRL was derived by dividing the LOAEL by an uncertainty factor of 10 (for use of a LOAEL in a sensitive population).

EPA (IRIS 2001) derived an oral reference dose (RfD) of 0.06 mg/kg/day for fluorine (soluble fluoride). The RfD was based on a NOAEL of 0.06 mg/kg/day and a LOAEL of 0.12 mg/kg/day for the cosmetic effect of dental fluorosis in children (Hodge 1950). The NOAEL was divided by an uncertainty factor of 1 to derive the RfD.

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride

Agency	Description	Information	Reference
<u>INTERNATIONAL</u> Guidelines:			
IARC	Carcinogenicity classification Fluoride and sodium fluoride	Group 3 ^a	IARC 2001
WHO	Drinking water guideline Fluoride	1.5 mg/L	WHO 2001
<u>NATIONAL</u> Regulations and Guidelines:			
a. Air:			
ACGIH	TLV-TWA Fluoride	2.5 mg/m ³	ACGIH 2000
	Fluorine	1.0 ppm	
	STEL (ceiling) Fluorine	2.0 ppm	
	Hydrogen fluoride	3.0 ppm	
EPA	Accidental release prevention Threshold quantity Fluorine	1,000 pounds	EPA 2001b 40CFR68.130 Table 1
	Hydrogen fluoride	1,000 pounds	
	Accidental release prevention Toxic end point Fluorine	0.0039 mg/L	EPA 2001a 40CFR68 Appendix A
	Hydrogen fluoride	0.0160 mg/L	
OSHA	PEL (8-hour TWA) General industry Fluoride	2.5 mg/m ³	OSHA 2001c 29CFR1910.1000 Table Z-1
	Fluorine	0.2 mg/m ³	
	Hydrogen fluoride	2.0 mg/m ³	
	PEL (8-hour TWA) Construction industry Fluoride	2.5 mg/m ³	OSHA 2001f 29CFR1926.55 Appendix A
	Fluorine	0.2 mg/m ³	
	Hydrogen fluoride	2.0 mg/m ³	
	PEL (8-hour TWA) Shipyards Fluoride	2.5 mg/m ³	OSHA 2001a 29CFR1915.1000 Table Z
	Fluorine	0.2 mg/m ³	
	Hydrogen fluoride	2.0 mg/m ³	

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride (*continued*)

Agency	Description	Information	Reference
<u>NATIONAL</u> (<i>cont.</i>)			
OSHA	Highly hazardous chemicals— Threshold quantity Fluorine	1,000 pounds	OSHA 2001d 29CFR1910.119 Appendix A
	Hydrogen fluoride	1,000 pounds	OSHA 2001e 29CFR1926.64 Appendix A
	Brazing and gas welding fluxes shall have a cautionary wording to indicate that they contain fluorine compounds		OSHA 2001b 29CFR1910.252(c)(1)
NIOSH	REL (TWA) Fluorine	0.2 mg/m ³	NIOSH 2001a
	Hydrogen fluoride	2.5 mg/m ³	NIOSH 2001b
	Sodium fluoride	2.5 mg/m ³	NIOSH 2001c
	IDLH Fluorine	25 ppm	NIOSH 2001a
	Hydrogen fluoride	30 ppm	NIOSH 2001b
	Sodium fluoride	250 ppm	NIOSH 2001c
USC	HAP		USC 2001 42USC7412
b. Water			
EPA	BPT effluent limitation—fluoride Maximum for 1 day Average of daily values for 30 consecutive days	6.1 kg/kkg 2.9 kg/kkg	EPA 2001c 40CFR415.82
	Effluent limitation—fluoride Maximum for 1 day Average of daily values for 30 consecutive days	75 mg/L 25 mg/L	EPA 2001e 40CFR422.42
	Groundwater protection standards at inactive uranium processing sites—listed constituents include fluorine and hydrogen fluoride		EPA 2001f 40CFR192 Appendix I

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride (*continued*)

Agency	Description	Information	Reference
<u>NATIONAL</u> (<i>cont.</i>)			
EPA	MCLG—fluoride	4.0 mg/L	EPA 2001j 40CFR141.51(b)
	MCL—fluoride	4.0 mg/L	EPA 2001k 40CFR141.62(b)
	Secondary MCL—fluoride	2.0 mg/L	EPA 2001l 40CFR143.3
	Water pollution—hazardous substance designation Hydrogen fluoride Sodium fluoride		EPA 2001r 40CFR116.4
c. Food			
EPA	Pesticides—fluorine compounds; residue tolerances		EPA 2001n 40CFR180.145
	apricots, beets, blackberries, blueberries, boysenberries, broccoli, brussels sprouts, cabbage, cauliflower, citrus fruits, collards, cranberries, cucumbers, dewberries, eggplant, grapes, kale, kohlrabi, lettuce, loganberries, melons, nectarines, peaches, peppers, plums, pumpkins, radish, raspberries, rutabaga, squash, strawberries, tomatoes, turnip, youngberries	7 ppm	
	potatoes	2 ppm	
	potatoes, processing waste	22 ppm	
	kiwifruit	15 ppm	
FDA	Adhesive component, indirect food additive—for use only as bonding agent for aluminum foil, stabilizer, or preservative Hydrogen fluoride Sodium fluoride	Total fluoride from all sources not to exceed 1% by weight of the finished adhesive	FDA 2000e 21CFR175.105(c)(5)

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride (*continued*)

Agency	Description	Information	Reference
<u>NATIONAL</u> (<i>cont.</i>)			
FDA	Bottled water—no fluoride added	<u>Temperature^b</u>	
		53.7–below	2.4
		53.8–58.3	2.2
		58.4–63.8	2.0
		63.9–70.6	1.8
		70.7–79.2	1.6
		79.3–90.5	1.4
	Bottled water—fluoride added	<u>Temperature^b</u>	
		53.7–below	1.7
		53.8–58.3	1.5
		58.4–63.8	1.3
		63.9–70.6	1.2
		70.7–79.2	1.0
		79.3–90.5	0.8
	Over-the-counter drug products Labeling—fluoride, fluorine, and sodium fluoride		FDA 2000b 21CFR355.50
			FDA 2000c 21CFR355.60
	Over-the-counter drug products Testing—fluoride		FDA 2000d 21CFR355.70
	Over-the-counter drug products Active ingredient—fluorine, hydrogen fluoride, and sodium fluoride		FDA 2000a 21CFR355.10
			FDA 2000f 21CFR310.545(a)(2)
	Surface component, food contact—sodium fluoride for use as preservative only		FDA 2000h 21CFR177.2800(d)(5)
d. Other			
ACGIH	Carcinogenicity classification Fluoride	A4 ^c	ACGIH 2000
	BEI		
	Fluorides in urine Prior to shift End of shift	3 mg/g creatinine 10 mg/g creatinine	
CPSC	Requirements for child- resistant packaging for household products containing elemental fluoride	More than 50 mg and more than 0.5%	CPSC 2001 16CFR1700

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride (*continued*)

Agency	Description	Information	Reference
<u>NATIONAL</u> (<i>cont.</i>)			
DOT	Hazardous materials Reportable quantity Fluorine Hydrogen fluoride Sodium fluoride	10 pounds 100 pounds 1,000 pounds	DOT 2001 40CFR172.101 Appendix A
EPA	RfD—fluorine	6×10^{-2} mg/kg/day	IRIS 2001
	Toxic chemical release reporting; Community Right-to- Know—effective date Fluorine Hydrogen fluoride	01/01/95 01/01/87	EPA 2001q 40CFR372.65
	Contaminated soil—fluoride	Concentrations greater than 10 times UTS	EPA 2001d 40CFR268.49(f)
	Hazardous waste—health based limits for exclusion of waste-derived-residue Fluorine residue concentration limit	4.0 mg/kg	EPA 2001g 40CFR266 Appendix VII
	Hazardous waste— identification and listing Fluorine Hydrogen fluoride	P056 U134	EPA 2001h 40CFR261.33(e) EPA 2001i 40CFR261.33(f)
	Pesticides—residue tolerances Sodium fluoride	Not more than 25% of pesticide formulation	EPA 2001m 40CFR180.1001(d)
	Superfund—reportable quantity Fluorine Hydrogen fluoride Sodium fluoride	1 pound 5,000 pounds 5,000 pounds	EPA 2001o 40CFR302.4 Appendix A
	Superfund—extremely hazardous Reportable quantity Fluorine Hydrogen fluoride	10 pounds 100 pounds	EPA 2001p 40CFR355 Appendix A
	Threshold planning quantity Fluorine Hydrogen fluoride	500 pounds 100 pounds	

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Agency	Description	Information	Reference
<u>STATE</u>			
a. Air			
Connecticut	HAP—fluoride, fluorine, and hydrogen fluoride		BNA 2001
Hawaii	Air contaminant—hydrogen fluoride		BNA 2001
Idaho	Toxic air pollutants Fluoride OEL EL AAC Fluorine OEL EL AAC	 2.5 mg/m ³ 0.167 pounds/hour 0.125 mg/m ³ 2.0 mg/m ³ 0.133 pounds/hour 0.1 mg/m ³	BNA 2001
Michigan	PEL (TWA) Fluoride Fluorine Hydrogen fluoride	 2.5 mg/m ³ 0.2 mg/m ³ 3.0 ppm	BNA 2001
Montana	Air contaminant (TWA) Fluoride Fluorine Hydrogen fluoride	 2.5 mg/m ³ 0.2 mg/m ³ 2.0 mg/m ³	BNA 2001
New Mexico	Toxic air pollutant Fluorides OEL Emissions Fluorine OEL Emissions	 2.5 mg/m ³ 0.167 pounds/hour 2.0 mg/m ³ 0.133 pounds/hour	BNA 2001
New York	Air contaminant (TLV) Fluoride Fluorine Hydrogen fluoride	 2.5 mg/m ³ 0.2 mg/m ³ 2.0 mg/m ³	BNA 2001
Washington	Toxic air pollutant—ASIL Fluoride Fluorine Hydrogen fluoride	 8.3 µg/m ³ 5.3 µg/m ³ 8.7 µg/m ³	BNA 2001

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Table 8-1. Regulations and Guidelines Applicable to Fluoride, Fluorine, Hydrogen Fluoride, and Sodium Fluoride (*continued*)

Agency	Description	Information		Reference
STATE (cont.)				
Washington	PEL Fluoride Fluorine Hydrogen fluoride (STEL)	2.5 mg/m ³ 0.2 mg/m ³ 3.0 ppm		BNA 2001
Wisconsin	Emission rate (pounds/hour) Fluoride Fluorine Hydrogen fluoride	<u><25 feet</u> 0.2088 0.1656 0.1272	<u>>25 feet</u> 0.8640 0.6720 0.4800	BNA 2001
b. Water				
Alaska	MCL—fluoride Secondary MCL—fluoride	4.0 mg/L 2.0 mg/L		BNA 2001
Arizona	Drinking water guideline—fluoride Reporting limit—fluoride	4.0 mg/L 2.0 mg/L		HSDB 2001 BNA 2001
California	Drinking water standards—fluoride	2.0 mg/L		HSDB 2001
Connecticut	MCL—fluoride	4.0 mg/L		BNA 2001
Delaware	Drinking water standards—fluoride	1.8 mg/L		HSDB 2001
Georgia	MCL—fluoride	4.0 mg/L		BNA 2001
Hawaii	Drinking water standards—fluoride	1.4–2.4 mg/L		HSDB 2001
Idaho	Groundwater quality standards—fluoride	4.0 mg/L		BNA 2001
Kansas	Agriculture—fluoride Livestock Irrigation Public health food—fluoride Domestic water supply	 2.0 mg/L 1.0 mg/L 2.0 mg/L		BNA 2001
Maine	Drinking water guideline—fluoride Maximum exposure guideline Action level	2.4 mg/L 2.4 mg/L 1.2 mg/L		HSDB 2001 BNA 2001

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Agency	Description	Information	Reference
<u>STATE</u> (<i>cont.</i>)			
Mississippi	Groundwater standards—fluoride	4.0 ppm	BNA 2001
Nebraska	MCL—fluoride	4.0 mg/L	BNA 2001
New Jersey	Groundwater quality criteria—fluoride PQL—fluoride	2.0 mg/L 0.5 mg/L	BNA 2001
New York	Groundwater effluent limitations—fluoride MCL—fluoride	3.0 mg/L 2.2 mg/L	BNA 2001 BNA 2001
North Carolina	Drinking water standards—fluoride	4.0 mg/L	HSDB 2001
North Dakota	MCL—fluoride	4.0 mg/L	BNA 2001
Oklahoma	MCL—fluoride	4.0 mg/L	BNA 2001
Pennsylvania	Drinking water standards—fluoride	2.0 mg/L	HSDB 2001
Rhode Island	MCLG—fluoride MCL—fluoride	4.0 ppm 4.0 ppm	BNA 2001
South Dakota	Groundwater quality standards—fluoride	2.4 mg/L	BNA 2001
Tennessee	MCL—fluoride	4.0 ppm	BNA 2001
Texas	MCL—fluoride	4.0 mg/L	BNA 2001
Utah	Groundwater standards MCL—fluoride	4.0 mg/L 4.0 mg/L	BNA 2001 BNA 2001
Vermont	Groundwater quality standards—fluoride Enforcement standard Preventive action level MCL—fluoride	 4.0 mg/L 2.0 mg/L 4.0 mg/L	BNA 2001 BNA 2001
Washington	MCL—fluoride	4.0 mg/L	BNA 2001
West Virginia	Groundwater standards	Not to exceed 4.0 mg/L	BNA 2001

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Agency	Description	Information	Reference
STATE (<i>cont.</i>)			
Wisconsin	MCLG—fluoride	4.0 mg/L	BNA 2001
	MCL—fluoride	4.0 mg/L	
	Groundwater standards—fluoride		BNA 2001
	Enforcement standard	4.0 mg/L	
	Preventive action limit	0.8 mg/L	
c. Food		No data	
d. Other			
Connecticut	Use of pesticides; control of registrations and uses—sodium fluoride	For use as a wood preservative	BNA 2001
Minnesota	Hazardous substance—fluoride (as F, as dust), fluorides (inorganic), fluorine, and hydrogen fluorine		BNA 2001
New Jersey	Hazardous substance—fluorine and hydrogen fluoride		BNA 2001

^aGroup 3: not classifiable as to its carcinogenicity to humans^bTemperature: annual average of maximum daily air temperatures (EF)^cA4: not classifiable as a human carcinogen

AAC = acceptable ambient concentrations; ACGIH = American Conference of Governmental Industrial Hygienists; ASIL = acceptable source impact levels; BEI = biological exposure indices; BNA = Bureau of National Affairs; BPT = best practicable control technology; CFR = Code of Federal Regulations; CPSC = Consumer Product Safety Commission; DOT = Department of Transportation; EL = emissions levels; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; HAP = hazardous air pollutant; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life and health; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NIOSH = National Institute for Occupational Safety and Health; OEL = occupational exposure limit; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; PQL = practical quantitation level; REL = recommended exposure limit; RfD = reference dose; STEL = short term exposure limit; TLV = threshold limit values; TWA = time-weighted average; USC = United States Code; UTS = universal treatment standards; WHO = World Health Organization